centrica energy

PL 691

Relinquishment Report

Relinquishment Report of License PL 691 in Block 6507/7

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1 Key License History

Summary

PL 691 was awarded on 8th February 2013, following an application made in the APA 2012, to a License Group comprising:

- Centrica Resources (Norge) AS: 40% (Operator)
- Faroe Petroleum Norge AS: 30%
- Statoil Petroleum AS: 30%

The work commitments and work periods for the license were:

Within 1 year from license award (by 8th February 2014)

- Reprocess 3D seismic
- Decision to drill an exploration well or relinquish the license

Overview of Meetings

All license meetings are summarised in Table 1.1.

Table 1.1 Summary of License Meetings.

Date	Purpose	Comments
12th Mar 2013	EC & MC	First PL 691 meeting. Covered miscellaneous license admin details. Operator presented APA 2012 vintage Manilow Prospect evaluation. Faroe gave brief update on seismic reprocessing.
24th May 2013	Workshop	Review of preliminary interpretation of Manilow Prospect on newly reprocessed FP13M1 survey
25th Nov 2013	EC & MC	Operator presented the Manilow Prospect evaluation with final risks and volumes

Reason for Relinquishment

The PL 691 Group reached agreement to relinquish the license in January 2014. The Manilow Prospect was the only identified prospect in the License and the basis for the relinquishment decision was the relatively high risk combined with modest volumes, which gave unattractive prospect economics. The license partners were unanimous on the decision to relinquish.

2 Database

Seismic Database

PL 691 is covered by the Merged FP13M1 survey which was the result of a Faroe Petroleum operated seismic reprocessing project undertaken jointly by PL 691 and PL 645 during 2012-13. This project fulfilled the seismic reprocessing commitment. The BPN0002 survey constitutes the underlying data over the Manilow Prospect. The area of the FP13M1 survey that is available to all PL 691 partners is shown in Fig. 2.1. The released surveys surrounding the license were used to interpret the main surfaces and place the Manilow prospect in a regional context.

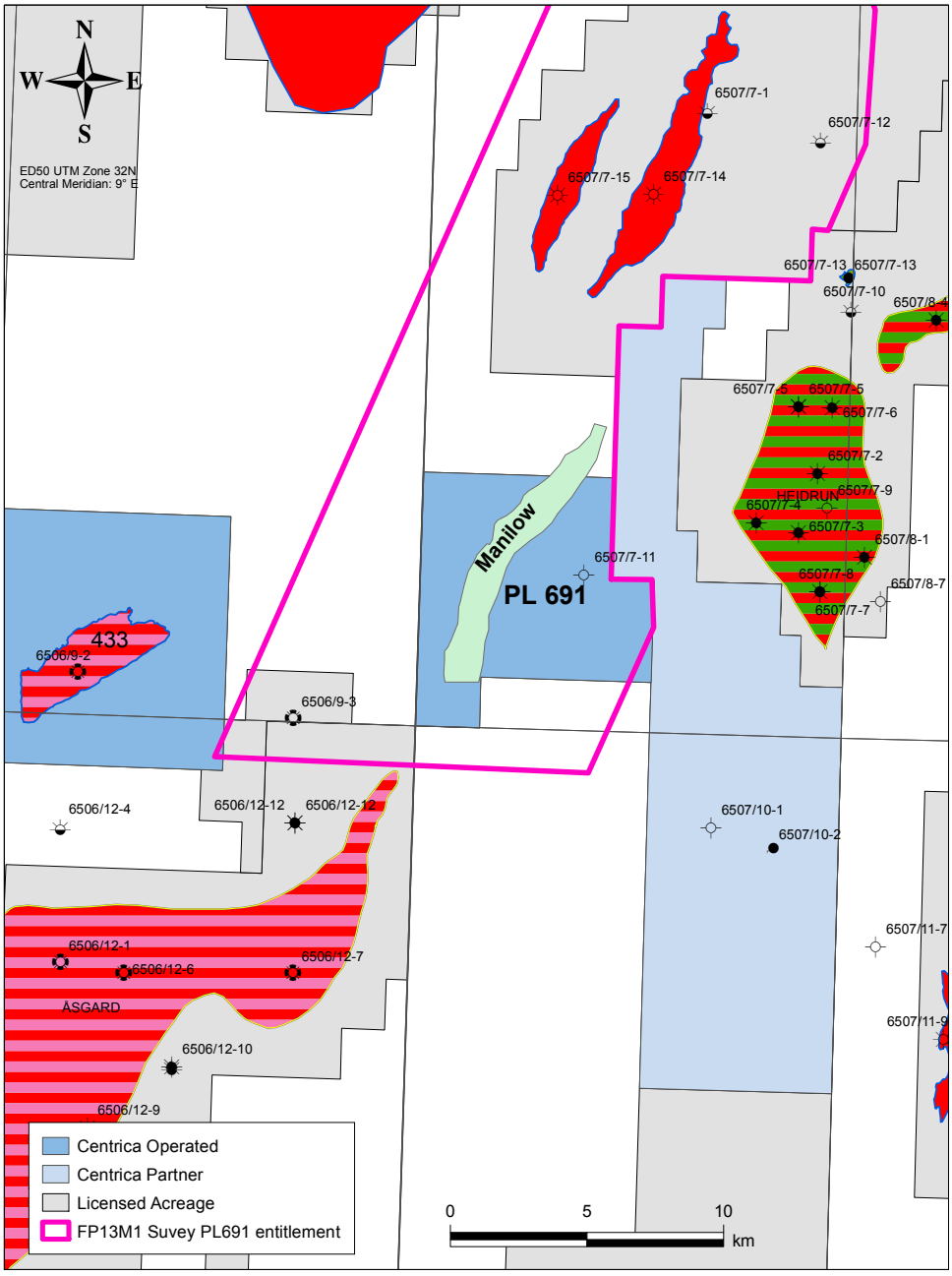


Fig. 2.1 Seismic Database. *The outline shown is the PL 691 entitlement to the FP13M1 survey. The remainder of the survey lies to the east and covers PL 645.*

Well Database

The wells in blocks 6506/11 & 12, to the west of PL691, were used to characterise reservoir and fluid properties for the Manilow Prospect. In addition, the partnership traded the unreleased Smørbukk North Discovery Well 6506/9-3 and this was also used. Wells to the east, in and around the Heidrun Field, are believed to be less representative of the potential Jurassic reservoirs in Manilow due to their shallower depth of burial. However the up dip dry well 6507/7-11S was a useful datapoint for the assessment of trap risk and highlighted the possibility of finding a thin Garn Fm reservoir.

3 Review of Geological Framework

The key risks at Manilow are caused by seismic imaging problems and therefore the major work item was to reprocess the seismic covering the prospect. The newly reprocessed FP13M1 survey has a better image and covers a larger area than any of the previous surveys interpreted over the Manilow Prospect. Interpretation of the FP13M1 survey revealed two possible interpretation models for Manilow. In order to identify the most likely model, structural restorations were undertaken on four dip lines through the prospect. The restorations were not conclusive, but did enable one interpretation model to be ranked slightly ahead of the other.

4 Prospect Update

The Manilow Prospect is an elongate Jurassic fault block situated within the Revfallet Fault Complex, which straddles the boundary between the Halten Terrace and the Nordland Ridge (Fig. 4.1). It is bounded to the east and west by normal faults that are both downthrown to the east (Fig. 4.2). It is the only identified prospect in the licence.

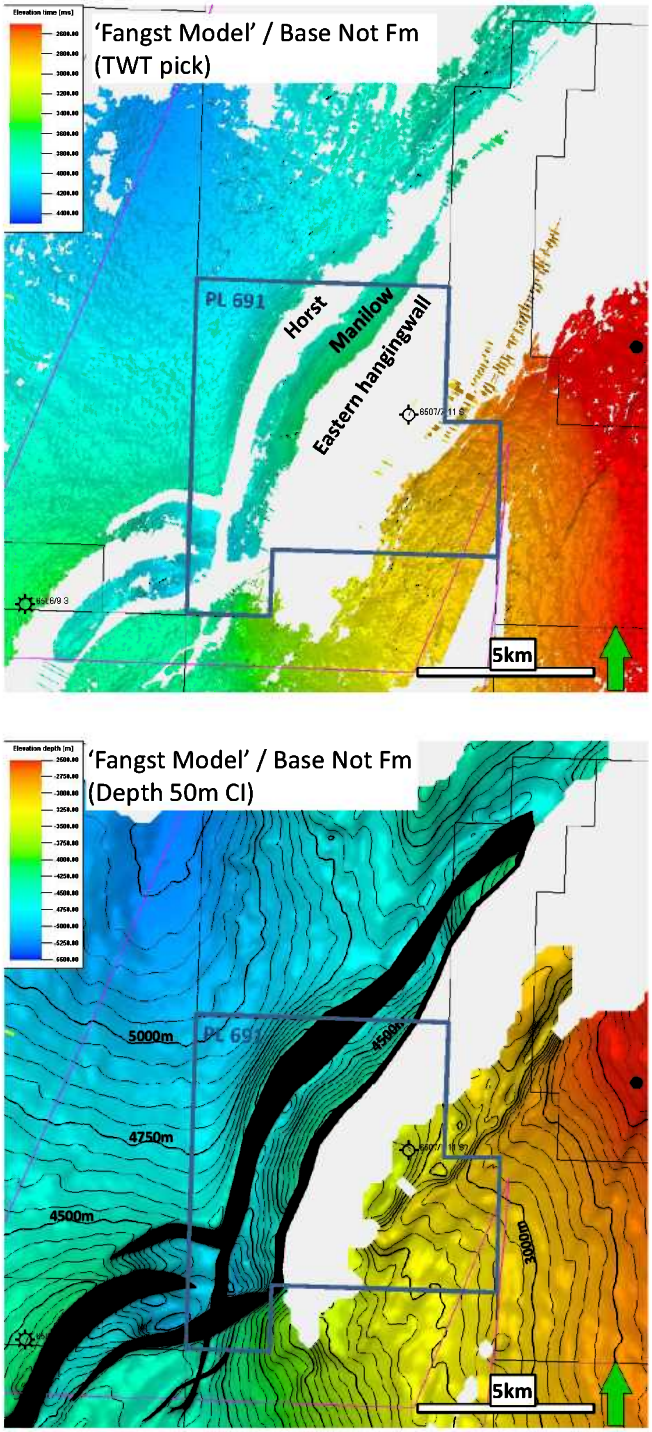


Fig. 4.1 Not Fm TWT and Depth maps. *At reservoir level the Not Fm is the clearest seismic marker and was picked across Manilow and the surrounding area. All other reservoir surfaces are isochored up and down from the Not Depth surface.*

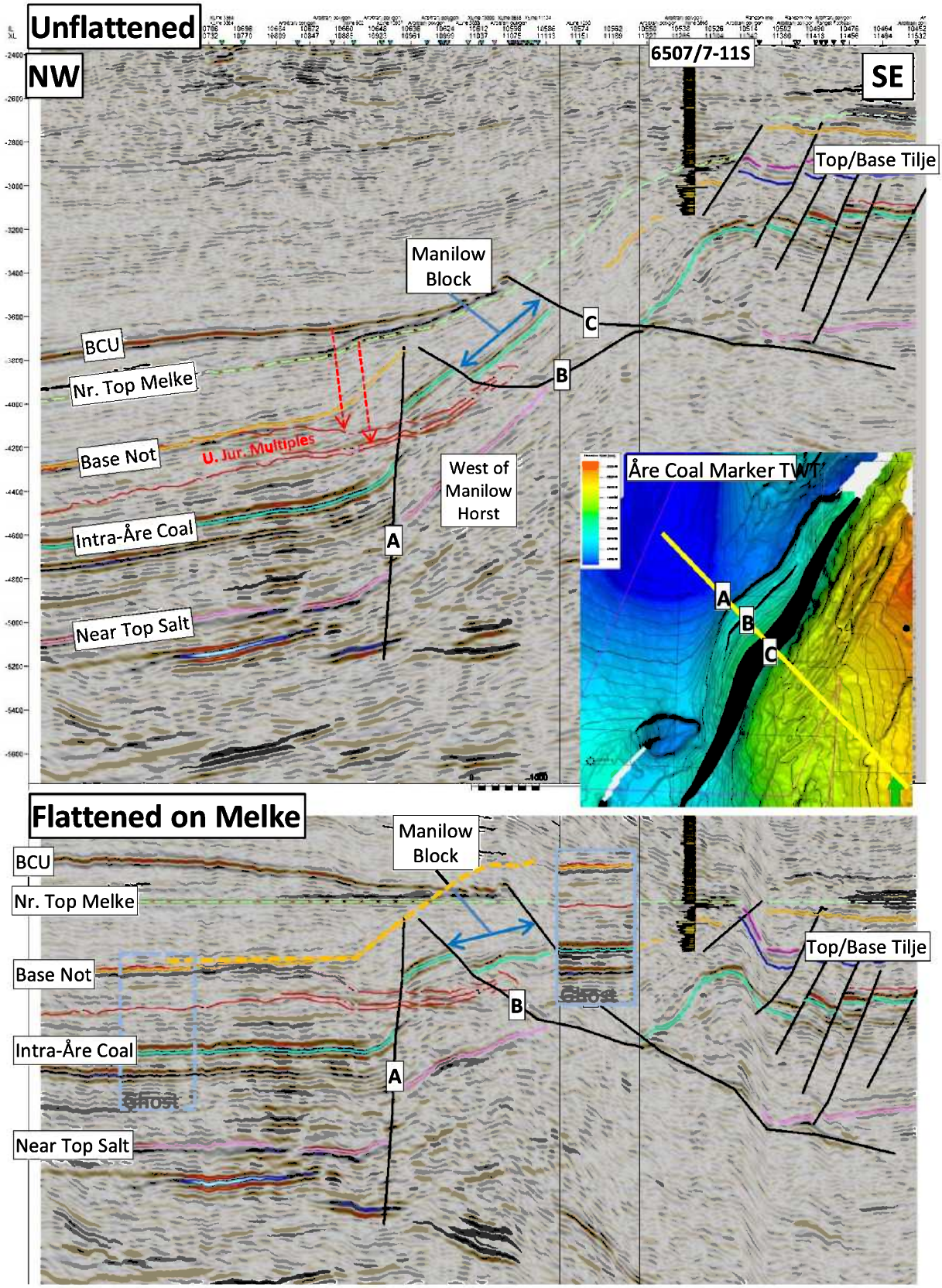


Fig. 4.2 Dip Seimic Line Through Manilow Prospect. *On this line the bright reflector is interpreted as the Åre Fm within the Manilow Block to show the reservoir erosion risk. In the lower panel the section is flattened on top Melke and the base Not Fm pick is projected above the BCU to show the likely serosion of the Garn, Ile and Tofte reservoir Fms*

There is a set of coherent reflectors within the Manilow block with a similar thickness to a typical Garn-Ile-Tofte-Tilje reservoir sequence. The bright reflector at the top of this package is believed to be the base of the Not Fm, but as the block is entirely fault bound this interpretation relies on a tricky jump correlation. It is possible to make a case for an alternative model where the bright reflector is interpreted as the intra-Åre Fm coal. One consequence of invoking this 'Åre coal' model is the likely BCU erosion of the Garn, Ile and Tofte Fms from the Manilow block, leaving only the Tilje Fm reservoir, which is unlikely to be a viable standalone reservoir. The 'Åre coal' model probably lacks the key reservoirs and hence the focus of the interpretation effort has been to choose between the two models. Work on the restoration of four dip lines suggests that both models are possible, but that the 'Not' model is most likely. However, it is difficult to ignore the continuousness of the Åre reflector, which appears to extend directly into the block on some dip lines through the south of the prospect.

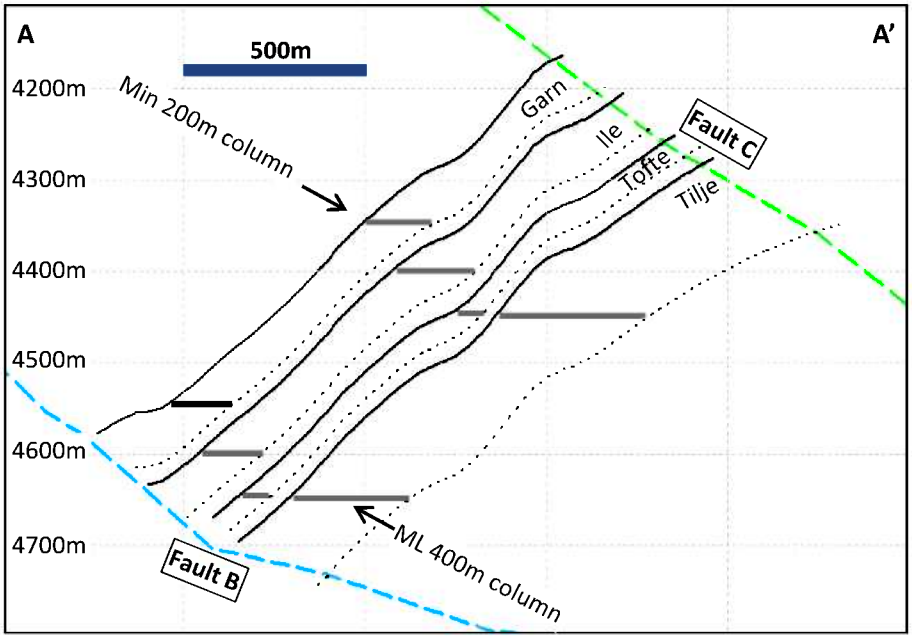
The eastern closure is the main source of trap risk. The fault bounding the crest of Manilow is defined by a consistent termination of the intra-Manilow reflectors along the length of the block. It is difficult to interpret the magnitude and sense of fault throw because the imaging in the hanging wall is poor (steep dips and heavily faulted). If the 'Not' model is invoked there is a max normal throw of ca. 200m at the crest of Manilow and less to the North and South

The Manilow prospect appears to be very favourably positioned for a gas or gas condensate charge but there are some potential complications for migration into the Manilow block. Firstly, the Prospect is recessed against the Nordland Ridge and its fetch area is restricted by the encroachment of the southern flank of Zidane and northern flank of Smørbukk North. Secondly, the western bounding fault has a large throw in the 'Not' model and may block migration from the west, diverting it into Smørbukk North.

The updated Manilow Prospect evaluation has a similar chance of success (COS) and volume range to those calculated for the APA 2012 application. Only minor modifications were made to the volumetric input parameters and the biggest uncertainty remains the position of the GWC (Fig. 4.3). Significant adjustments were made to some individual risk elements. For example the reservoir presence risk was increased and is now the key risk, the retention risk was reduced due to improved fault imaging and the charge risk was reduced due to the nearby Smørbukk North Discovery.

At the time of application it was believed that there was a small discovery in thin Lange Fm sandstones in well 6507/7-11S, which could have extended down dip into PL 691. However, a subsequent re-evaluation of the petrophysics analysis indicates that the interpretation of pay was erroneous and due to a section of 'bad hole' adversely affecting the wireline logs.

An updated summary of the Manilow Prospect is given in Fig. 4.4.



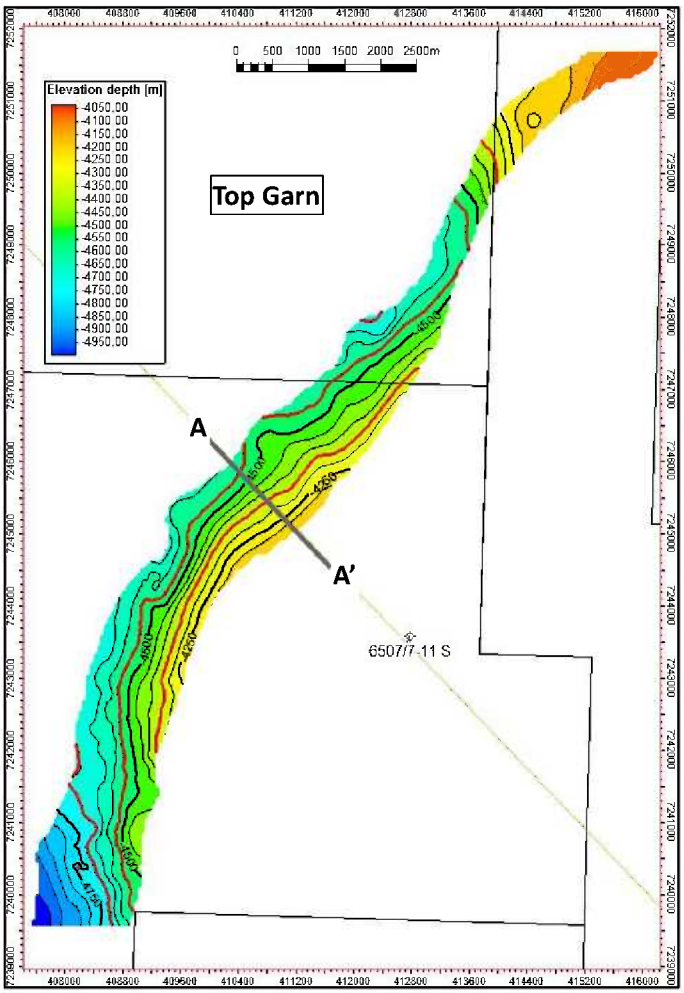


Fig. 4.3 Depth Cross Section and Top Garn Depth Map. *The minimum, most likely and maximum GWCs are shown on the map. The location of the cross section only allows the minimum and most likely GWCs to be shown. No volumes were calculated for the narrow northern culmination. All top and base reservoir surfaces were isochored up/down from the base Not Fm surface.*

Table 5: Prospect data (Enclose map)

Block	6507/7	Prospect name	Manilow	Discovery/Prosp/Lead	Prospect	Prosp ID (or New!)	NPD will insert value	NPD approved (Y/N)	
Play name	NPD will insert value	New Play (Y/N)		Outside play (Y/N)	No				
Oil, Gas or O&G case:	Gas	Reported by company	Centrica Energi	Reference document				Assessment year	2014
This is case no.:	1 of 1	Structural element	Revfallet Fault Com	Type of trap	Structural	Water depth [m MSL] (>0)	320	Seismic database (2D/3D)	3D
Resources IN PLACE and RECOVERABLE		**Main phase**				**Associated phase**			
Volumes, this case		Low (P90)	Base, Mode	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean	High (P10)
In place resources	Oil [10^6 Sm^3] (>0.00)								
	Gas [10^9 Sm^3] (>0.00)	3.23	4.57	15.19	32.05				
Recoverable resources	Oil [10^6 Sm^3] (>0.00)					0.22	0.31	1.08	2.29
	Gas [10^9 Sm^3] (>0.00)	2.09	2.98	9.47	19.85				
Reservoir Chrono (from)	Bathonian	Reservoir litho (from)	Garn Fm	Source Rock, chrono primary	Volgian	Source Rock, litho primary	Spekk Fm	Seal, Chrono	Callovian
Reservoir Chrono (to)	Pliensbachian	Reservoir litho (to)	Tilje Fm	Source Rock, chrono secondary	Callovian	Source Rock, litho secondary	Melke Fm	Seal, Litho	Melke Fm
Probability [fraction]									
Technical (oil + gas + oil & gas case) (0.00-1.00)	0.24	Oil case (0.00-1.00)	0.00	Gas case (0.00-1.00)	0.24	Oil & Gas case (0.00-1.00)	0.00		
Reservoir (P1) (0.00-1.00)	0.55	Trap (P2) (0.00-1.00)	0.70	Charge (P3) (0.00-1.00)	0.65	Retention (P4) (0.00-1.00)	0.95		

Parametres:	Low (P90)	Base	High (P10)
Depth to top of prospect [m MSL] (> 0)	4300	4200	4100
Area of closure [km^2] (> 0.0)	2.0	7.0	12.0
Reservoir thickness [m] (> 0)	42	60	77
HC column in prospect [m] (> 0)	300	400	600
Gross rock vol. [10^9 m^3] (> 0.000)	0.370	0.566	0.719
Net / Gross [fraction] (0.00-1.00)	0.69	0.82	0.90
Porosity [fraction] (0.00-1.00)	0.09	0.13	0.17
Permeability [mD] (> 0.0)	1.0	10.0	100.0
Water Saturation [fraction] (0.00-1.00)	0.16	0.25	0.34
Bg [Rm3/Sm3] (< 1.0000)	0.0030	0.0029	0.0029
1/Bo [Sm3/Rm3] (< 1.00)			
GOR, free gas [Sm^3/Sm^3] (> 0)	6452	9009	14599
GOR, oil [Sm^3/Sm^3] (> 0)			
Recov. factor, oil main phase [fraction] (0.00-1.00)			
Recov. factor, gas ass. phase [fraction] (0.00-1.00)			
Recov. factor, gas main phase [fraction] (0.00-1.00)	0.56	0.65	0.74
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)	0.56	0.65	0.74

The Garn Fm reservoir parameters are listed as it is the primary target. The Ile, Tofte and Tilje Fm reservoirs were also included in the high case scenarios that were used to define the consolidated volume range (recorded above). Note that 4.5% inerts (CO_2) have been subtracted from the volumes.

Condensate (assoc. phase) recovery factor same as gas (main phase) recovery factor as very limited reservoir condensate drop out is expected.

For NPD use:					
Temperature, top res [°C] (>0)	150	Innrapp. av geolog-init:	NPD will insert value	Registrert - init:	NPD will insert value	Kart oppdatert	NPD will insert value
Pressure, top res [bar] (>0)	650	Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato	NPD will insert value
Cut off criteria for N/G calculation	1.Vsh >50%	2. Porosity >8%	3.			Kart nr	NPD will insert value

Fig. 4.4 Manilow Prospect Data Table.

5 Technical Evaluations

The Manilow development assumption is a 20km tie back to the Åsgard J-template and a tie-in to Åsgard B from the J template. First production is assumed to be 2024. Two horizontal Garn producers are assumed in the P50 case. In the P10 case the assumption is five horizontal producers.

6 Conclusions

Manilow is a very interesting Jurassic fault block, unfortunately the prospect economics did not reach the level required to take a drill decision and there was unanimity within the partnership on the decision to relinquish. The low COS and high development costs were the main factors contributing to the relatively modest economic results. In the future it may be possible to mitigate some of the key risk elements with improved seismic imaging technology. However, the operator (and at least one of the partner companies) did view the latest PGS 'Geostreamer' data covering Manilow and saw no imaging improvement compared to the latest reprocessing of the conventional 3D (FP13M1).